Compliance and Implementation Monitoring of Forestry Best Management Practices for Harvesting in South Carolina, 2004-2005

South Carolina Forestry Commission

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Best Management Practices Monitoring Report BMP-6

Published by the South Carolina Forestry Commission,
Columbia, SC July 2006

This project was funded in part by the US Environmental Protection Agency under a Section 319 grant through the South Carolina Department of Health & Environmental Control.

EXECUTIVE SUMMARY

Overall compliance with *South Carolina's Best Management Practices for Forestry* (BMPs) has increased to 98% for timber harvesting operations. This study documents continual improvement since compliance monitoring began in 1989. Results are based on the comprehensive evaluation of 200 recently harvested sites throughout South Carolina. Implementation of 105 different individual BMPs was considered. Each site was rated for compliance in several BMP categories, including road systems, road stream crossings, streamside management zones, harvesting systems, and overall compliance.

INTRODUCTION

This is the seventh study conducted to determine BMP compliance rates during silvicultural activities since the current edition of *South Carolina's Best Management Practices for Forestry* (BMPs) was published in 1994. Six of those studies reported compliance with BMPs related to timber harvesting, and three documented compliance during site preparation activities.

Overall compliance with BMPs related to harvesting rose to 98%, demonstrating continual improvement since compliance monitoring began in 1989. Harvesting compliance in 2005 was 94%.

Year of Publication	Harvesting BMP Compliance	Site Preparation BMP Compliance
1991	84.5%	
1993	84.7%	
1994	89.5%	
1996		86.4%
2000	91.5%	98.0%
2005	94.0%	96.0%
2006	98.0%	

Table 1. Harvesting and Site Preparation Compliance for SC by year of publication.

During 2004-2005, two hundred recently harvested sites were evaluated by specially trained BMP Foresters. Each site was rated for compliance in several BMP categories, including road systems, road stream crossings, streamside management zones (SMZs), harvesting systems related to site productivity, and harvesting systems related to water quality. Site evaluation included consideration of 105 individual practices described in *South Carolina's Best Management Practices for Forestry.*

Of the 200 sites evaluated, 15 were rated with Excellent Compliance, 181 with Adequate Compliance, and 4 sites with Inadequate Compliance. Major problems noted on inadequate sites were:

- Harvesting of the streamside management zone.
- Blockage of an ephemeral stream.
- Poor planning and construction of an intermittent stream crossing.
- Improper culvert design and installation in a haul road crossing.
- Oil/hydraulic spills.

STUDY METHODS

Between August 2004 and January 2005, two hundred recently logged sites were evaluated for compliance and implementation of BMPs.

Site Selection

Aerial surveys were utilized to remove bias during site selection. This monitoring survey was designed to sample sites from among all landowner classes, physiographic regions, soil types, and management regimes. Harvested sites selected were at least ten acres in size, had been harvested within the previous six months, and no site

preparation activity had been conducted. No association with streams or wetland areas was required to be included as a monitoring site.

To begin, a total of 400 recently logged sites throughout South Carolina were identified. The number of sites located in each county was proportional to the annual timber harvest reported in US Forest Service Timber Product Output data.

Within each county, a random number generator was used to select half of the identified sites for inclusion in the study.

Aerial view of timber harvesting.

Landowner Questionnaire

Once a site was selected for inclusion in monitoring, the BMP Forester contacted each landowner to obtain permission to visit the site. Prior to the site inspection, each landowner was questioned concerning their level of familiarity with forestry BMPs, use of a professional forester, and use of a written contract. Four categories of landowners were identified for the purpose of this study:

1) Non-industrial private landowners who own less than 1,000 acres of forest land.
2) Non-industrial private landowners who own more than 1,000 acres of forest land.
3) Public lands, including both state and federal lands.
4) Industrial lands, owned by forest products companies and timberland investment groups.

Site Evaluation

Site inspections were made during the winter of 2004 by specially trained BMP Foresters. Each major category of BMPs was evaluated on a pass/fail basis depending on the responses to a series of yes/no questions related to successful implementation of each BMP. On each site, 105 different individual BMPs were considered. BMP compliance was evaluated in each of five categories:

1) Road Systems
2) Road Stream Crossings
3) Streamside Management Zones (SMZs)
4) Harvesting Systems – Site Productivity
5) Harvesting Systems – Water Quality

Overall BMP compliance for each site was determined after all individual BMP categories were fully evaluated. Each site was given an overall rating of Excellent, Adequate, or Inadequate depending on the level of BMP compliance, as follows:

Excellent Compliance – All recommended BMPs were implemented successfully, and no water quality impacts resulted from the harvesting operation. Significant additional steps were taken to stabilize the site, reduce impacts to water quality or site quality, or to mitigate aesthetic impacts of the harvest.

Adequate Compliance – Recommended BMPs were implemented successfully, and no water quality impacts resulted from the harvesting operation.

Inadequate Compliance – Recommended BMPs were not implemented or were implemented without success. Likely water quality impacts were noted as a result of poor or improper BMP implementation.

Compliance and Implementation

Determination of Excellent, Adequate, or Inadequate compliance with BMPs was closely linked with the likelihood or presence of water quality impacts, and was consistent with applicable state and federal water quality laws.

This study also allowed for analysis of BMP implementation, or the actual execution of individual practices and all practices within each category. Implementation was noted as Yes, No, or No with Significant Risk for each applicable practice. Significant Risk indicates that there is a potential for future water quality impact should

conditions degrade, and that deficiencies are correctable before such an impact occurs.

Failure to implement specific practices may or may not result in water quality impacts. For example, a site in hilly terrain may not have out-sloped roads as specified in BMPs, but other practices may have been implemented to achieve overall compliance.

MONITORING RESULTS

Road Systems – 98.5% Acceptable Compliance
Roads were constructed to provide access for forest management activities on 65 of the 200 sites that were evaluated. During the field evaluation, BMPs for road construction and stream crossings on forest roads were considered separately.

Logging road designed to reduce erosion.

Of the 65 sites that included road construction, one was rated as unacceptable for compliance with BMPs. This bottomland Coastal site included an unnecessary wetland road that was poorly designed and interfered with normal water flow due to inadequate cross drainage.

A total of 1,084 applicable BMPs were evaluated on the sites with road construction. Implementation rate of applicable BMPs was 93.6%. Significant risk was noted for five individual practices, including road design, size and frequency of culverts or other crossing structures, culvert stabilization, excessive equipment encroachment during wetland road construction, and failure to maintain safe distance from a public water supply intake.

Individual practices with the lowest implementation rates include out-sloping of roads in steep terrain, stabilization of culvert inlets, and use of water bars to retire roads where broad-based dips could not be constructed. Among wetland roads, major concerns were removal of temporary fill and, where dredge material is used as fill, construction of proper ditching and cross drainage.

Exceptional implementation (100%) was noted for several important practices, including:

- Roads were kept outside of Streamside Management Zones except where necessary to cross streams.
- Culverts, turnouts, and broad-based dips empty road runoff onto undisturbed forest floor.
- In steep terrain, frequency of road grading was minimized.
- Road fill was properly stabilized and maintained to prevent erosion.
- Discharges in wetlands were avoided if practical alternatives existed.

Example of improper culvert installation.

Ephemeral stream flow is blocked by this road.

Road Stream Crossings -- 92.3% Adequate Compliance

In this survey, 13 of the 200 sites surveyed for compliance with BMPs involved the construction of haul road stream crossings. Of these, one Piedmont site was rated as inadequate due to an improperly installed culvert which altered stream flow and caused a water quality impact.

On the 13 sites with road stream crossings, a total of 116 applicable BMPs were evaluated. Five individual practices were improperly installed or not present, resulting in road stream crossing BMP implementation rate of 95.7%. Sizing and installation of culverts according to BMP guidelines was the most frequently cited issue.

Notably, road stream crossings were avoided where reasonably possible on 30 sites, greatly reducing the risk of water quality impact.

Streamside Management Zones – 96.2% Adequate Compliance

Perennial or intermittent streams were present and streamside management zones were necessary on 130 of the 200 sites included in this monitoring survey. Appropriate SMZs were retained on 125 of those sites. Five sites were rated as inadequate because of harvested SMZs, or excessive harvesting within the SMZ.

Excessive debris in an intermittent stream.

A total of 1,481 individual practices relative to streamside management zones were evaluated with 96.1% implementation. Five sites were noted for significant risk due to retaining less than 50 square feet of overstory basal area within the SMZ, emptying of road runoff into ephemeral areas, and failure to keep tops and other logging debris out of steam channels.

A well-marked streamside management zone.

Harvesting Systems – 97.5% Adequate Compliance

The application of BMPs related to the harvesting operation was evaluated on each of the 200 sites included in this survey. Of these, 195 were rated as acceptable. The category of Harvesting Systems includes practices that could potentially impact site productivity and water quality, including log deck location, skid trail layout, skid trail stream crossings, degree of rutting, area affected by skidding equipment, and fuel and oil spills.

Five sites were rated as inadequate primarily because of failure to stabilize skid trails and skidding or blockage of ephemeral areas.

A total of 3,111 applicable practices were evaluated. Implementation rate of harvesting system BMPs was 95.6%. Significant risk was noted on three sites involving establishment of streamside management zones, bladed skid trail construction, and stabilization of skid trails on erosive slopes. The most frequently cited concern was consideration of land use, wildlife habitat, and aesthetics in planning harvests, especially as they approach 100 acres is size.

A skid trail debris crossing.

A properly removed and stabilized debris crossing.

A poorly stabilized skid trail.

Overall BMP Compliance for harvesting – 98%

In this survey, overall compliance with BMPs related to timber harvesting in South Carolina was 98%, compared to 94% in 2005. Of the 200 sites inspected, 15 sites were rated as Excellent, 181 as Adequate, and 4 sites were rated as Inadequate.

On sites that were rated as inadequate, one or more BMPs were not implemented or were implemented incorrectly. As a result of deficiencies in BMP implementation, evidence was seen of a water quality impact. Examples of documented evidence of water quality impacts include sediment trails reaching a perennial or intermittent stream, algae blooms in a perennial or intermittent stream, and excessive logging debris within a stream channel.

Two of the four sites with inadequate overall compliance failed in the categories of both Streamside Management Zones and Harvesting Systems. The remaining sites with inadequate overall compliance failed in one category each; one in Road Stream Crossings and the other in Harvesting Systems for an oil/hydraulic spill. Specific deficiencies in BMP compliance on sites that were rated as inadequate include:

- Harvesting of the streamside management zone.
- Blockage of an ephemeral stream.
- Poor planning and construction of an intermittent stream crossing.
- Improper culvert design and installation in a haul road crossing.
- Oil/hydraulic spills.

Over the course of this survey, a total of 5,852 individual applicable BMPs were evaluated on 200 sites. Overall implementation rate of applicable BMPs was 95.4%.

Fourteen individual applicable BMPs on eight sites were noted for significant risk to water quality. An actual water quality impact occurred on only on one of those sites, which included four notations of significant risk. Individual practices rated for significant risk included:

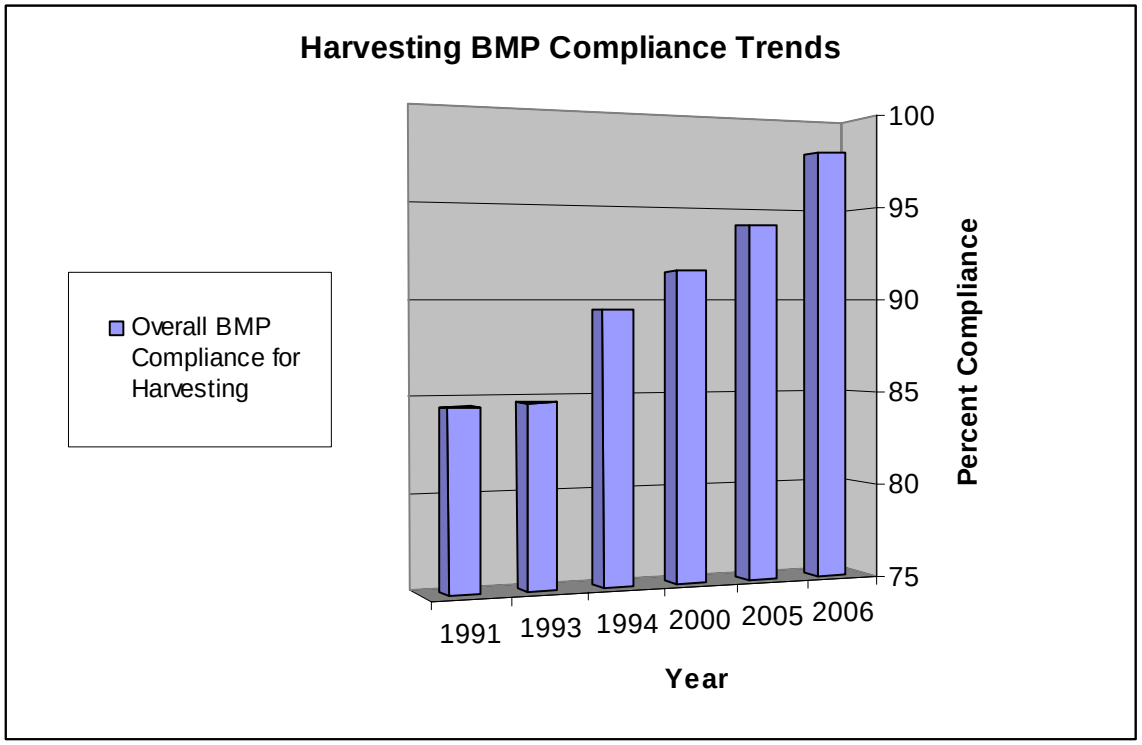
- Excessive debris in the stream channel.
- Retaining less than 50 square feet of overstory basal area in the streamside management zone.
- Poor construction of bladed skid trails, and failure to stabilize primary skid trails.
- Road design, road stream crossing location, and timber harvest planning.
- Culvert size, capacity, and stabilization.
- During wetland road construction, encroachment of equipment outside the lateral boundaries of fill, and failure to prevent discharge near a public water supply intake.

Left: Example of an inadequate streamside management zone.

Right: Oil spill on a logging deck.

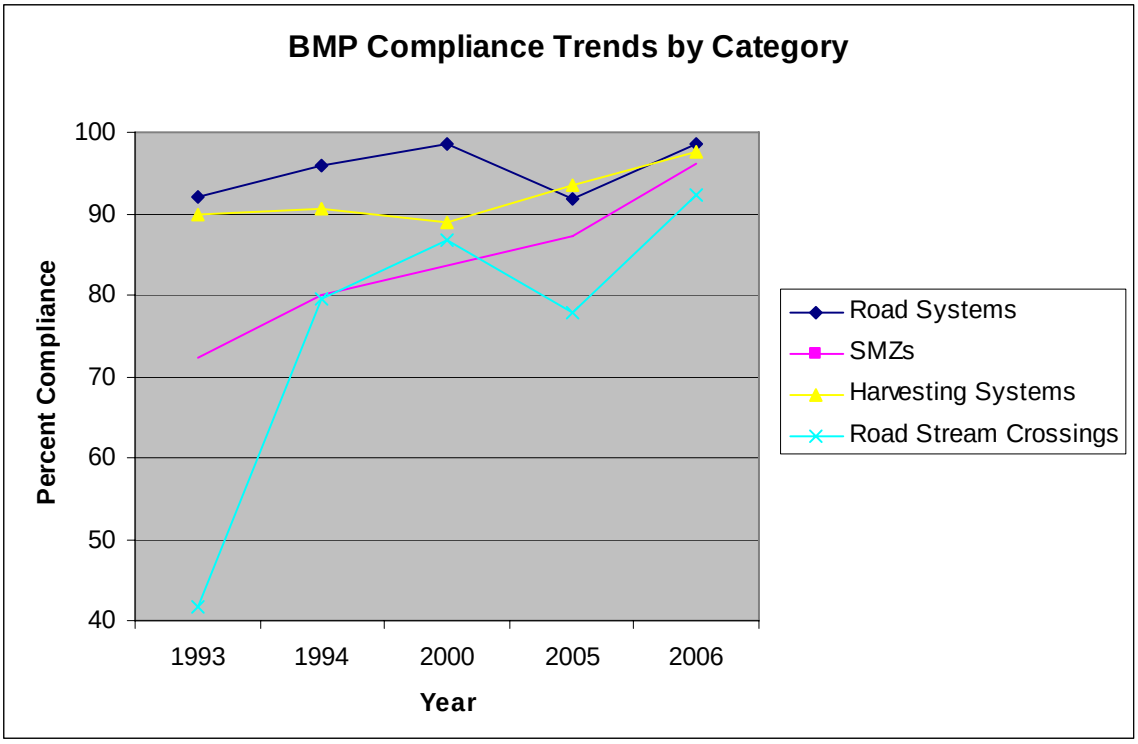
SUMMARY AND DISCUSSION

Overall compliance with silvicultural BMPs related to timber harvesting was 98% in this study. Harvesting compliance has steadily increased since the first monitoring conducted in 1989.

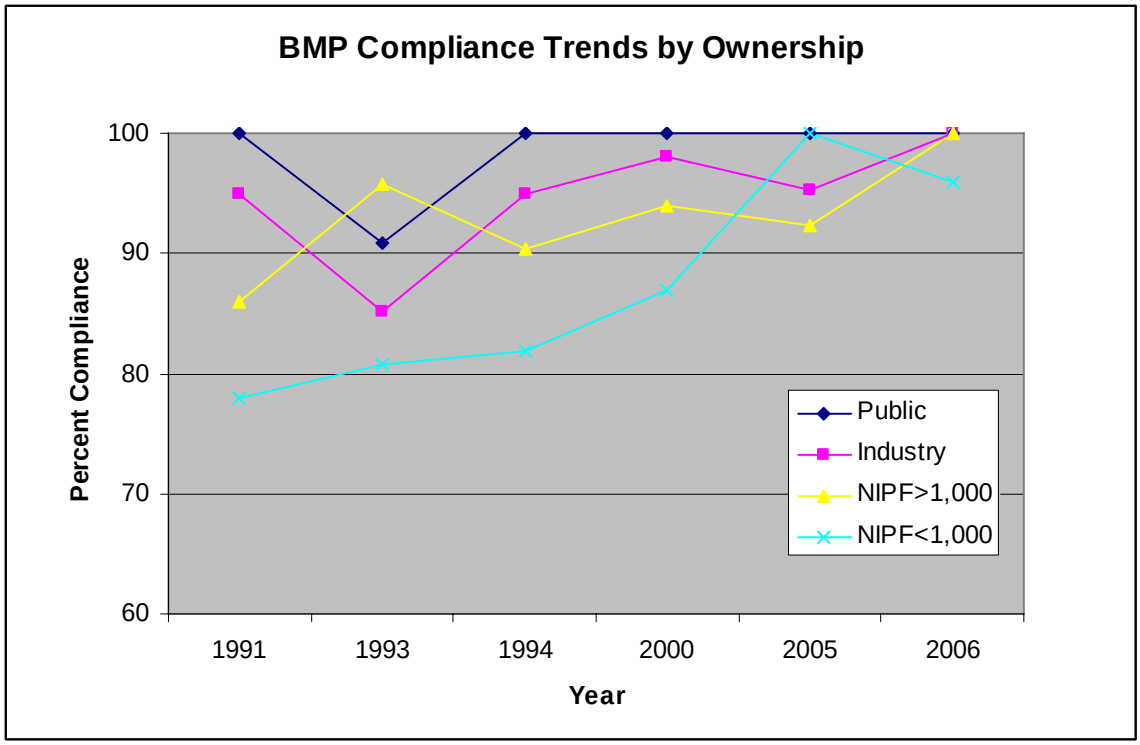


Road Stream Crossings had the lowest compliance among the BMP categories at 92.3%. This category also showed the greatest improvement, increasing from 77.8% compliance in the previous survey. Targeted education programs and improved harvest planning to avoid unnecessary stream crossings contributed to this increase. All other categories showed compliance above 95%.

A well-constructed ford crossing with matted approach.



All four of the sites rated with Inadequate Overall Compliance were owned by non-industrial private landowners with less than 1,000 acres of forest land. This was also the most common ownership type, with 93 of the 200 sites. Overall BMP compliance was 94% for this ownership type.



Inadequate sites ranged from 10 to 212 acres in size, and occurred in Piedmont, Coastal, and Pee Dee regions of the state. However, there were some commonalities. On three of the four sites rated as Inadequate:

- The landowner was not familiar with forestry BMPs.
- The landowner did not rely on a forester during harvest.
- Three of the inadequate sites had a written contract for harvest, but only one included BMP compliance in the contract.
- The dominant soil texture was sandy loam. Previous surveys have indicated lower compliance on upland clay soils.

As part of the survey, each landowner was questioned about their familiarity with BMPs, use of a professional forester, and use of a written contract during harvesting.

- The average harvest size in this study was 62 acres.
- 67.5% of all landowners were familiar with BMPs.
- Only 44.6% of non-industrial private landowners with less than 1,000 acres were familiar with BMPs.
- 81.5% of landowners relied on the assistance of a professional forester during harvesting.
- 97.0% of landowners had a written contract.
- 83.5% of landowners with a written contract required BMP compliance as part of that contract.

RECOMMENDATIONS

Since regular monitoring of BMP implementation began in South Carolina in 1989, overall compliance has continued to improve. Many factors have contributed to the increased compliance with and awareness of forestry BMPs:

- Educational efforts on active forestry operations through the SCFC Courtesy BMP Exam program.
- Targeted training to address areas of historically low BMP implementation.
- Increased availability of training for loggers, foresters, and forest landowners.
- Support from companies that participate in the American Forest & Paper Association's Sustainable Forestry Initiative program.
- Improved cooperation between state agencies, federal agencies, and private organizations.
- Improved cooperation between SCFC and regulatory agencies for consistency when enforcement actions are initiated.
- Increased professionalism in the logging community.

Courtesy BMP Exams are offered to active forestry operations located by specially trained BMP Foresters through aerial observation, voluntary notification, or complaints. During a Courtesy BMP Exam, the BMP Forester visits the site while the silvicultural operation is ongoing and provides the operator with site-specific recommendations to properly implement BMPs on the tract. Upon completion of the operation, the BMP Forester examines the site, and the operator is given an opportunity to correct any deficiencies that exist. When excessive damage has occurred, resulting in a likely water quality impact, deficiencies are noted on the monthly Courtesy Exam Report. Through this report, the site is referred to the SC Department of Health and Environmental Control for possible enforcement action, and to forest industry. Forest industry utilized the report to determine when corrective action and additional training is necessary for their suppliers.

Professional education programs are an important part of BMP compliance.

In cooperation with the South Carolina Forestry Association and Clemson University, logger training through the Timber Operations Professional (TOP) Program has been in place since 1994. Initial training in the TOP Program includes a basic understanding of BMPs, and continuing education provides opportunities for more in-depth training. As a result of problems noted in past monitoring surveys, additional workshops have been created to address BMPs for streamside management zones, harvest planning, and forest road construction. Continuation of this program and participation by forest industry is essential to further improve compliance with BMPs.

In order to maintain high BMP compliance and continually improve implementation, the following suggestions should be enacted:

- BMP educational opportunities such as TOP Programs and workshops should continue to be offered regularly and with minimal cost to forestry operators. New classes should be developed to further advance BMP awareness and target priority issues.
- The Courtesy BMP Exam program should be continued. This preventative program provides opportunities for one-on-one training for loggers, road construction contractors, and site preparation contractors. Follow-up by SCDHEC and forest industry ensures that problems are remediated.
- Additional efforts should be made to increase awareness of BMPs among small private landowners, and encourage inclusion of BMP compliance in written contracts.
- Future monitoring surveys should follow more closely the protocol established for BMP monitoring by the Southern group of State Foresters Water Resources Committee.